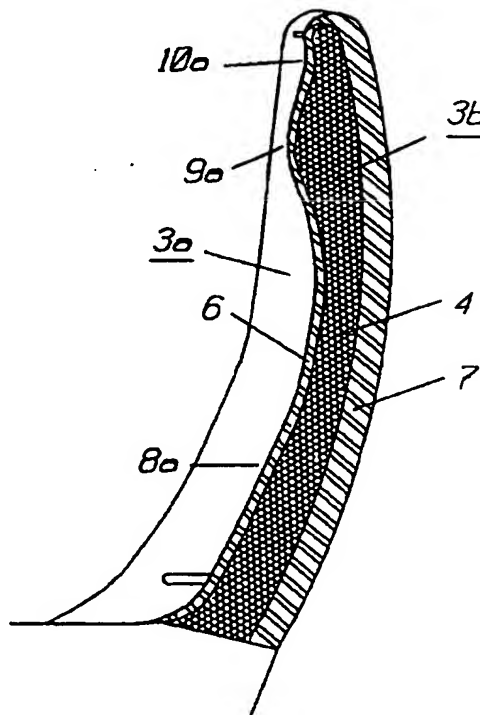


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(54) Title: VEHICLE SEAT HAVING VARIABLE RESILIENCY		
(57) Abstract <p>A vehicle chair or seat (1) arranged to counteract generation of whiplash injuries which depend on the normal resilient action of the vehicle seat, and in which the seatback (3) of the vehicle seat is formed so that it is at least slightly moved rearwardly and is solidified to some extent when a person (5) in the vehicle is pressed with great force against said seatback (3), for instance if the vehicle is run into from behind or, secondarily, in connection to a violent deceleration like in connection to a collision, depending on the rebound effect of the seat. To this end the seatback (3) is formed with a section containing a solidifiable material (4) of a type which quickly and easily can adapt itself to the shape, the size and the position of the back, the neck and the head of a person which is pressed rearwardly against said seatback (3), and which is thereafter, in a second stage, solidified in the shape thereby taken.</p>		



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VEHICLE SEAT HAVING VARIABLE RESILIENCY

The present patent application generally relates to a vehicle seat which is arranged so as to counteract the part of the generation of whiplash injuries which depends on the normal elastic action of the vehicle seat. The invention
5 is more particularly concerned with a seatback of a vehicle seat which is formed so that it can move or rotate slightly rearwards and can be solidified to some extent when a person in the vehicle is pressed with great force against said seatback, for instance if the vehicle is run into from behind, or in connection to a heavy deceleration like during a collision, whereby said
10 person in the car is secondarily thrown rearwardly. The seatback of the vehicle seat also is formed so that it automatically adapts its solidified shape to the body of the person which is pressed rearwardly, independently of the size, shape and position of the body in the horizontal and in the vertical direction.

15 The vehicle seat of the invention, or more exactly the seatback of the vehicle seat, is in the first place intended to be installed in newly made cars and is formed for counteracting the generation of whiplash injuries. Such injuries frequently appear when a vehicle is run into from behind by another vehicle whereby the passengers of the vehicle is, primarily, violently pressed
20 rearwardly and is thereafter, secondarily, thrown forwardly (rebound effect). The throwing forwardly is to a great extent depending on the fact that ordinary car seats are elastic, or have an elastic upholstery which makes the seatback act as a spring. This is also true for modern vehicle seats which are sometimes made very stiff in order not to break apart in case the vehicle is
25 run into from behind.

Whiplash injuries also can appear in connection to a head-on collision whereby the passenger is thrown forwardly, is arrested by the car safety belt and is thereafter thrown rearwardly. The frequency of whiplash injuries have increased during the latest years depending on increasing traffic density and
30 in many cases also increasing traffic intensity. The problem has, to an increasing extent been considered by experts, in view of the fact that more than 50% of the injuries which appear depending on car crashes are, or include whiplash injuries.

Many attempts have been made to solve the problem that whiplash
35 injuries appear, in the first place by reconstructing the vehicle seats in various ways. Experts are, however, not sure of the mechanism of generation of

whiplash injuries and how to avoid same. During the construction work it is important to study the moments of the motor car, the seat and seatback of the car and the of the person sitting in said seat, which movements can give rise to said whiplash injuries, in particular the moment of the person who is
5 thrown rearwardly, and not least the oftenly great shearing strength to which back vertebrae and cervical vertebrae can be subjected.

It can be supposed that the ordinary elasticity of the seatback of the vehicle seat (chair) can be a contributory reason for generation of whiplash injuries for the reason that the seatback acts as a type of spring which makes
10 the person in the seat be, secondarily, thrown forwardly as a reaction of the sudden and often violent movement backwards of the person.

The present invention is intended to solve the above mentioned problem in that the body of the person in the seat, when thrown rearwardly, is first softly caught by the active part of the seatback and by an elastic
15 upholstery of the seatback, whereupon the seatback quickly adapts itself to the shape of the body which has been thrown rearwardly and is transformed to a solidified or unresilient body.

According to the invention this is accomplished in that the seatback of the seat is mounted slightly movable in relation to a solid frame of the seat
20 and in that the active part of the seatback contains a shapeable material which upon a strong press contact forms itself to a support body which is accurately adapted to the back, the neck and the head of the person in the seat.

This action is very important in order to avoid that the spine be
25 straightened out or that vertebrae be displaced what can lead to whiplash injuries or can make whiplash injuries very serious. It is also important that the movement of the active part of the seatback moves rearwardly in a special path in relation to its solid frame, and that shapeable material of the seatback, the neck support and the head support is of such character that it
30 quickly and correctly adapts itself, at the very collision moment, to the shape of the body which is pressed into same, in particular since it is not possible to foresee exactly how the body meets the seatback of the seat when thrown rearwardly, and also considering the fact that the shape, the size and the pattern of movement of the bodies of the driver or the passengers can
35 vary within wide ranges.

It is further important that the shapeable material of the seatback does

not impair the seating comfort during ordinary use of the seat, on the contrary that said material can be arranged so as to improve the seating comfort for the driver and the passengers.

5 The shapeable material can be enclosed in a flexible chamber in the seatback, or a section of the seatback can be filled with a material of such type that it can easily be brought to follow the shape of the contacting human body, and which, when subjected to a strong load, maintains the shape thus taken after the person in the seat has been pressed violently rearwards. An example of a useful material is small balls of a plastic material, 10 like cellular plastic balls. The material can be placed in suitable places of the seatback, preferably having a soft upholstery in front of said shapeable material. Other components and safety means which are present in the seatback may make it necessary to place the shapeable material further inside the seatback but this does not make the properties thereof substantially 15 worse. Preferably the shapeable material is filled into several small sections which are linked to each other so that the plastic balls are kept in place and can not unintentionally rearrange themselves or fall to the bottom of the section. The plastic balls should still be relatively loosely packed, so that the plastic balls can adapt themselves to the shape of the driver or passenger 20 even during normal driving.

The flexible chamber with the plastic balls, or the above mentioned section may have a constant amount of air, or the air volume can be increased by using an air compressor or an air pump. It is thereby possible to provide a comfortable support for the body, which support can be perfectly 25 adapted to each individual body. The flexible chamber or section preferably is formed with a type of evacuation valve which lets air out when the chamber or section is very strongly compressed, like during a collision.

For additionally reducing the deceleration forces in the next phase, after the shapeable material of the seatback has adapted itself to the back, 30 the neck and the head of the passenger and has taken a solid and stable shape, and for eliminating, or at least strongly reducing, the resilient action of the seatback caused by the so called rebound effect the seatback can be split into two parts, namely an outer, fixed mounted, solid frame and an inner active seatback part or a moveable frame. The outer frame should be stable 35 and ought to be solidly mounted in the vehicle, in the same way as conventional vehicle seats of modern vehicles, whereas the inner frame can

be formed flexible in some way, for instance flexible in several stages. The active inner part or inner frame of the seatback can be rotatably connected to the outer fixed frame, whereby the inner part or frame has the possibility of rotating slightly rearwards with the lower part thereof when subjected to a strong load from in front.

It is also possible to mount the inner frame in slides at the upper part and the lower part thereof, or in bars which become deformed when subjected to such heavy loads that can appear when the vehicle is run into from behind or, secondarily, in case of a head-on collision, so that the inner frame as a whole is displaced slightly rearwardly if subjected to a heavy load.

It should, however, be possible to move the lower part of the inner part or frame to a greater extent than the upper part thereof since the mass of the passenger body is greater at said lower part than at said upper part. Therefore the unloading of force normally is made to the greatest extent at the lower part of the inner frame.

The inner frame can be arranged spring biased, or it can be connected to a shock absorber or damper, for instance damper pistons which may contain liquid crystals which can be triggered electrically so that the damping effect can very quickly be changed from no damping at all to maximum damping. It is possible to provide such change of the damping effect in only some thousands of a second. The damper thereby provides a soft damping in the rearward direction, and, in its pressed back position, the damping effect is increased so that there is practically no rebound effect at all.

It is also possible to mount the seatback as a whole rotatable against the seat by means of shock dampers whereby the same effect is obtained as for a seatback comprising a movable inner frame co-operating with an outer frame.

It is also possible to arrange the active inner part of the seatback as a separate unit having a textile, or textile like cover which yields elastically when subjected to very strong press forces, of which cover is connected to the solid outer frame over joints, like seams, which yield or break when subjected to very strong press forces.

Further characteristics and advantages of the invention will be evident from the following detailed specification, in which reference will be made to the accompanying drawings. In the drawings figure 1 shows a side view of a vehicle seat with a car driver sitting thereon in normal driving position, and

figure 2 shows, in a greater scale, a vertical cross section through the seatback of the seat of figure 1. Figure 3 shows, in the same view as in figure 1, the situation when the car driver is thrown or pressed heavily rearwardly against the seatback of the vehicle seat, and figure 4 shows, in the same view of that of figure 2, how the shape of the seatback is changed when the car driver is thrown rearwardly. Figure 5 is a transversal cross section through a seatback of a vehicle seat and comprising an outer frame and an inner frame. Figure 6 is a vertical cross section through the seatback of the seat while the vehicle is moving at normal condition, and figure 7 shows how the inner frame is rotated rearwardly following a collision. Figures 8 and 9 show, in the same views as those of figures 6 and 7, a seatback having an outer frame and an inner frame, but in which the inner frame can be moved in relation to the outer frame on an upper and a lower slide, and in which apparatus a shock damper of special type is used for controlling the function of the inner frame in relation to the outer frame.

Figures 1-4 show a motor car having a vehicle chair 1 with a seat 2 and a seatback 3. As usual the chair can be displaced in the longitudinal direction and can preferably be raised and lowered. The seatback 3, likewise as usual, is adjustable so as to take different inclination in relation to the seat 2. It is important that the frame 3a of the seatback 3 is stably connected to the seat 2 so that it can not become released depending on a violent actuation that can appear during a collision.

According to the invention the seatback is formed with an outer frame 3a and an inner seatback part 3b, which inner part has a section 4 containing a shapeable material, which can for instance be cellular plastic balls or a plastic material the plasticity of which is depending on the temperature and which is such that the seatback while subjected to normal load can change its shape and adapt itself to the shape of the vehicle driver 5 or passenger so as to provided an optimum seating comfort but which, when subjected to such strong forces which may appear during a collision, in a first phase, adapts itself to the shape of the back, the neck and the head of the driver or passenger 5 and thereafter, in a second phase, provides a solid body having a shape which corresponds to the said shape adapted to the shape of the passenger thereby forming a stable support for the passenger, duly adapted to the shape of said passenger. Thereby the rebound effect is reduced, which effect otherwise usually appears in the seatback of the vehicle chairs.

In the illustrated case the section 4 having the shapeable material is provided between a relatively thin front layer 6 of a soft upholstery and a rear layer 7 of a soft upholstery which can optionally be made thick or thin.

The inner section 4 can be split into several relatively small
5 compartments, each compartment container containing a predetermined amount of a shapeable material, like cellular plastic balls. Thereby it is prevented that said plastic balls concentrate on the bottom of the inner section 4. The casing of the inner section or the compartments thereof can be made of a air tight material, and the section or the compartments thereof
10 can be inflated with air to a certain pressure. Each casing also can be formed with an over pressure valve which lets air out when the compartment is subjected to a heavy compression force, like in connection to a collision. The inner section or the compartments thereby presents a stiff, solid back support for the driver or passenger.

15 In normal use of the vehicle chair, as shown in figures 1 and 2, the seatback is only slightly loaded by the back 8 of the driver or passenger, whereas the neck 9 and the head 10 of the person normally have no noticeable contact with the neck and head support 9a, 10a of the chair.

If the car is run into from behind, or if the car is involved in a head-on
20 collision the driver and passenger is primarily, and secondarily, respectively, thrown rearwardly against the seatback 3 sliding over the seat 2. This happens with such force that the soft upholsteries 6 and 7 of the seatback 3, and to some degree also the inner section 4 of the seat back 2, are compressed, at the same time as the shapeable material 4 changes shape so
25 as to follow the back 8, the neck 9 and the head 10 of the passenger, thereby providing an optimum large force distribution area. As soon as the material 4 has adapted itself to the shape of the driver/passenger, and the air which was originally present in the section of the compartments has been forced out, the material becomes stabilized thereby forming a solid body
30 having very little, if any, resilient action. Therefore the driver/passenger is softly braked to stop in a movement which is rather firm, thereby substantially eliminating the rebound effect of the seatback. Therefore there is practically no rebound effect of the above mentioned type and it has thereby been possible to strongly reduce the risque of generation of whiplash
35 injuries.

In figure 4 is shown how the soft upholstery 6 and 7 at the front side

and at the rear side of the shapeable material 4 is compressed and how the shapeable material is compressed at some places and is expanded at other places so as to form itself following the shape of the back 8, the neck 9 and the head 10 of the driver/passenger. Thus the material 4 is formed with a
5 rather strongly compressed portion 8a corresponding to the back 8 of the passenger, a slightly expanded portion 9a corresponding to the neck 9 of the passenger and a slightly compressed portion 10a corresponding to the head 10 of the passenger.

10 Normally the lower portion of the upper body of the passenger, which is the heaviest portion of the body, is very strongly pressed against and partly into the shapeable material 4, and therefore it is preferred that the section, or the compartments, comprising the shapeable material has its greatest thickness at the lower part of the seatback. By an internal displacement of
15 shapeable material 4 said material quickly adapts itself to the shape of the body of the passenger in its maximum introduced condition, whereupon the material is solidified thereby forming a substantially firm body together with the upholsteries 6, 7 which gives a very little, if any, rebound effect. Thereby it has been possible to reduce the risque of generation of whiplash injuries to a great extent.

20 For further improving the properties of the seatback it can be formed as shown in figures 5-9. In said figures is shown how the seatback is composed of an outer frame 11 which is firmly secured to the seat, and an inner frame 12 which is mounted movable. In a first embodiment, shown in figures 5-7, the inner frame 12 is rotatable about pins 13 at the upper part of
25 the outer frame 11. At the lower part the inner frame can be kept in a neutral position by any resilient means, or by springs, or by plastic or metal bars which are elongated and/or break apart at high load, and which maintain the inner frame 12 in the neutral position, shown in figure 6, until it is loaded very strongly, for instance in connection to a collision, whereby the inner
30 frame 12 rotates rearwardly as indicated in figure 7. Thereby the inner frame 12 is softly damped and brakes the movement rearwardly of the human body 5 to stop at the same time as the shapeable material is reoriented whereby said seatback encloses parts of the back, the neck and the head of the passenger thereby forming a substantially solid and firm body which does not
35 provide any rebound effect.

Figures 8 and 9 show an alternative type of mounting of the inner

frame 14. Said inner frame 14 is slideable in an upper slot 15 and in a lower slot 16 guided by upper pins 17 and lower pins 18, respectively. In this case the inner frame 14 is kept in a basic position by a shock absorber or damper 19 which is connected between a point 20 substantially intermediate the height of the inner frame and the seatback and a point 21 at the seat located some distance from the seatback, so that the shock damper gets a suitable lever arm between said parts. The vehicle chair is formed with one, or eventually more shock dampers on each side of the seatback. The shock damper can be of conventional hydraulic type, whereby it makes it possible to adjust of the inclination of the seatback, and it provides a normal elasticity between the seat and the seatback. In a special embodiment of the shock damper the hydraulic oil may contain liquid crystals the mutual directions of which can be triggered by means of electricity. With a certain orientation of crystals the shock damper acts as a normal shock damper and provides a soft, damped braking of the movement rearwards of the human body; with another orientation of the crystals, which is initiated when the piston is expanded to its maximum when pressed rearwardly by the body of the passenger which is thrown rearwards, said crystals influence the damping properties of the hydraulic piston so that said damping is drastically increased. A (not illustrated) movement sensor can be arranged to trigger the damping properties of the shock damper to maximum damping effect in case of a collision, thereby stiffening the seatback so that the elasticity thereof is substantially reduced after the body of the passenger has been thrown backwards, and so that the otherwise following throwing forwards is minimized.

In figure 8 the seatback with the inner frame 14 is shown in its normal, slightly elastic position, and in figure 9 the inner frame 14 is shown moved rearwardly out of the outer frame 11. It is obvious that the lower part of the inner frame 14 is moved rearwards a longer distance out of the outer frame 11 than the upper part of the inner frame 14.

It is obvious that the same effect as described above in connection to a seatback comprising an outer frame and an inner frame can be obtained in that the entire seatback is rotatably mounted against the seat by means of one or more shock dampers. It may also be preferred to form the shock dampers so as to provide a stepwise increased damping when expanded rearwardly.

REFERENCE NUMERALS

	1	vehicle seat (chair)	13	pin of rotation
	2	seat	14	inner frame
5	3	seatback	15	slot
	4	shapeable material	16	slot
	5	driver/passenger	17	pin
	6	upholstery	18	pin
	7	upholstery	19	shock damper (absorber)
10	8	back	20	mounting point
	9	neck	21	mounting point
	10	head		
	11	outer frame		
	12	inner frame		

C L A I M S

1. Vehicle chair or seat arranged to counteract generation of whiplash injuries which depend on the normal resilient action of the vehicle seat, characterized in that the seatback (3) of the vehicle seat (2) is formed with an outer part (3a; 11) which is fixedly connected to the vehicle seat (2) and an inner part (3b; 12) which is movable rearwardly in relation to said out part (3a; 11), and in that said inner part is formed so that it becomes solidified to some extent when a person in the vehicle is pressed with great force against said seatback (3), for instance if the vehicle is run into from behind or, secondarily, in connection to a violent deceleration like preceding a head-on collision.
2. Vehicle seat according to claim 1, characterized in that the seatback (3) of the vehicle seat is formed so that it automatically adapts itself, in solidified condition, to the shape of the human body which is pressed rearwardly, irrespective of the shape, size and position of the human body in horizontal and vertical direction, and in that the inner part of the seatback comprises a section (4) having a flowable and shapeable material (4) in addition to an ordinary soft upholstery.
3. Vehicle seat according to claim 2, characterized in that the shapeable material (4) comprises a bag, or several small compartments, containing cellular plastic balls or any type of a plastic, preferably particulate material, in which the balls or particles, when subjected to slight pressure are capable of rearranging themselves, and which, when subjected to a strong pressure provide a solid body.
4. Vehicle seat according to 3, characterized in that the inner bag or the compartments containing the flowable material are made of an air tight material and are inflated to a predetermined extent with air, and in that said bag or each compartment is formed with an over pressure valve allowing air to escape therefrom when said bag or each individual compartment is strongly compressed.
5. Vehicle seat according to any of the preceding claims, characterized in that the seatback is built up by an outer frame (11) which is firmly mounted in relation to the seat (1) of the vehicle chair and an inner frame (12; 14) which is capable of rotating (13) or being displaced (15-18) a limited distance in relation to the outer frame (11) so that said inner frame (12), in

case of being strongly loaded from in front, is rotated or is displaced at least slightly rearwardly in relation to the outer frame (11).

5 6. Vehicle seat according to claim 5, **characterized** in that the inner frame (12) is mounted rotatable about pins (13) at the upper part of the inner frame (12), and that the lower part of the inner frame (12) is movable against the action of a damping or resilient means or a means which breaks if the seatback is strongly loaded in the direction rearwardly.

10 7. Vehicle seat according to claim 5, **characterized** in that the inner frame (14) is displaceable a limited distance rearwardly in relation to the outer frame (11) from a normal position and guided in slots (15, 16) over guide pins (17, 18) so that said inner frame as a whole can be displaced rearwardly in relation to the firmly mounted outer frame (11).

15 8. Vehicle seat according to claim 6, **characterized** in that the inner frame (14), or the seatback as a whole, is kept in a normal position by shock dampers (19) which are mounted between the seat (2) of the vehicle chair (1) and the seatback (3) and which allows a certain resilient pressing rearwardly of the inner frame (14) or the seatback (3), respectively.

20 9. Vehicle seat according to claim 8, **characterized** in that the shock dampers (19) are formed so as to allow a resilient pressing rearwardly by a continuous or a stepwise increased force in case said press force is weak to medium strong, whereas said shock dampers (19) in case the press force is very strong prevents or makes a return movement in the direction forwards impossible or almost impossible after the seatback has been moved rearwardly a predetermined distance.

25 10. Vehicle seat according to claim 9, **characterized** in that the shock dampers (19) are of hydraulic type, and that the hydraulic oil thereof contains flowable crystals which can be brought to quickly change structure and direction, whereby said crystals in a first position allows an adjustment of the inclination of the seatback and a resilient moving rearwardly/forwardly of the
30 seatback, whereas said crystals in a second position very drastically increases the damping property and thereby the possibility for the inner frame or the seatback, respectively, to rebounding in the direction forwardly.

AMENDED CLAIMS

[received by the International Bureau on 26 September 1997 (26.09.97);
original claims 1-10 replaced by new claims 1-7 (2 pages)]

1. A vehicle chair or seat arranged to counteract generation of
whiplash injuries which depend on the normal resilient action of the vehicle
5 seat, which seatback (3) of the vehicle seat (2) is formed with an outer part
(3a; 11) which is fixedly connected to the vehicle seat (2) and an inner part
(3b; 12) which is movable rearwardly in relation to said out part (3a; 11), and
in which said inner part is formed so that it becomes solidified to some extent
when a person in the vehicle is pressed with great force against said
10 seatback (3), for instance if the vehicle is run into from behind or,
secondarily, in connection to a violent deceleration like preceding a head-on
collision, whereby the seatback (3) of the vehicle seat is formed so that it
automatically adapts itself, in solidified condition, to the shape of the human
body which is pressed rearwardly, irrespective of the shape, size and position
15 of the human body in horizontal and vertical direction, **characterized** in that
the inner part of the seatback comprises a bag, or several small
compartments containing, in addition to an ordinary soft upholstery, a
flowable and shapeable material (4) in the form of cellular plastic balls or any
type of a plastic, preferably particulate material, in which the balls or
20 particles, when subjected to slight pressure are capable of rearranging
themselves, and which, when subjected to a strong pressure provide a solid
body, and in that the inner bag or the compartments containing the flowable
material are made of an air tight material and are inflated to a predetermined
extent with air, and in that said bag or each compartment is formed with an
25 over pressure valve allowing air to escape therefrom when said bag or each
individual compartment is strongly compressed.

2. Vehicle seat according to claim 1, **characterized** in that the
seatback is built up by an outer frame (11) which is firmly mounted in
relation to the seat (1) of the vehicle chair and an inner frame (12; 14), in
30 which the bag with the shapable material is mounted, and which is capable
of rotating (13) or being displaced (15-18) a limited distance in relation to the
outer frame (11) so that said inner frame (12), in case of being strongly
loaded from in front, is rotated or is displaced at least slightly rearwardly in
relation to the outer frame (11).

35 3. Vehicle seat according to claim 2, **characterized** in that the inner
frame (12) is mounted rotatable about pins (13) at the upper part of the inner

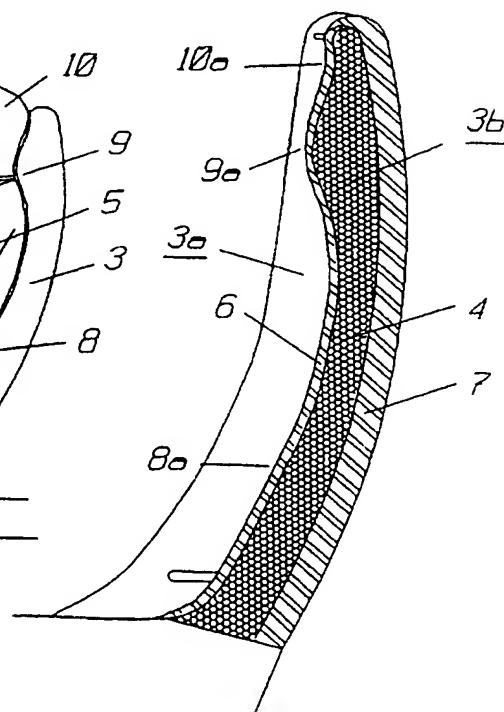
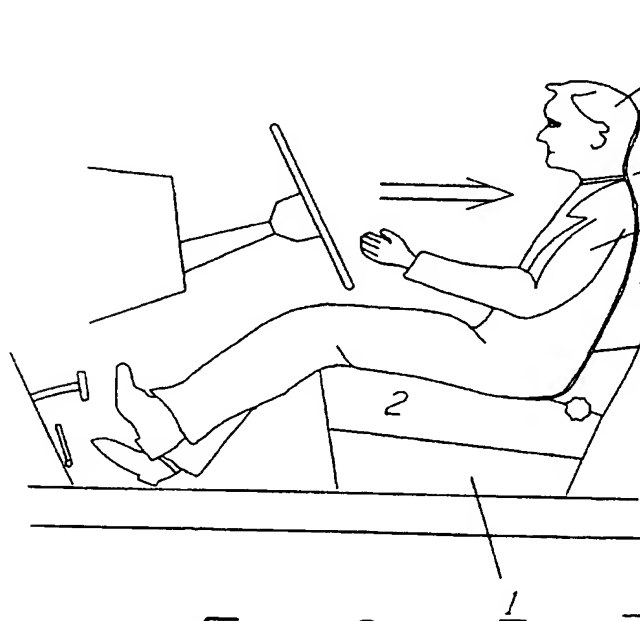
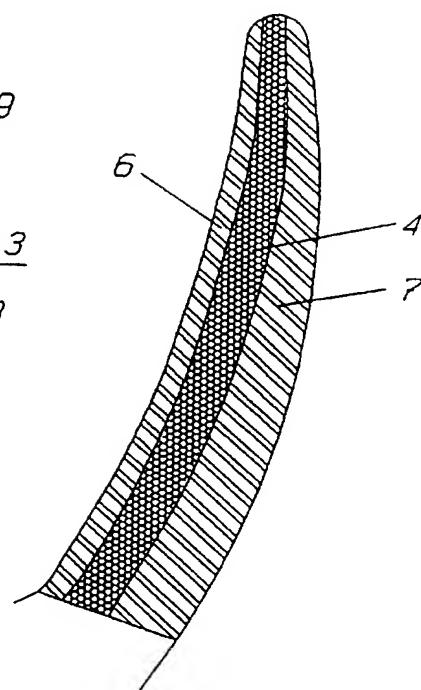
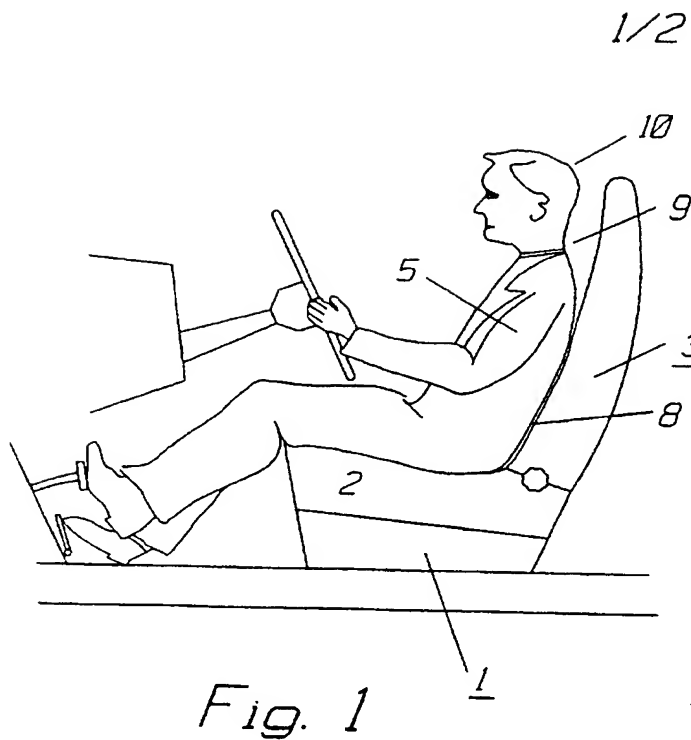
frame (12), and that the lower part of the inner frame (12) is movable against the action of a damping or resilient means or a means which breaks if the seatback is strongly loaded in the direction rearwardly.

4. Vehicle seat according to claim 3, **characterized** in that the inner
5 frame (14) is displaceable a limited distance rearwardly in relation to the outer frame (11) from a normal position and guided in slots (15, 16) over guide pins (17, 18) so that said inner frame as a whole can be displaced rearwardly in relation to the firmly mounted outer frame (11).

5. Vehicle seat according to claim 4, **characterized** in that the inner
10 frame (14), or the seatback as a whole, is kept in a normal position by shock dampers (19) which are mounted between the seat (2) of the vehicle chair (1) and the seatback (3) and which allows a certain resilient pressing rearwardly of the inner frame (14) or the seatback (3), respectively.

6. Vehicle seat according to claim 5, **characterized** in that the shock
15 dampers (19) are formed so as to allow a resilient pressing rearwardly by a continuous or a stepwise increased force in case said press force is weak to medium strong, whereas said shock dampers (19) in case the press force is very strong prevents or makes a return movement in the direction forwards impossible or almost impossible after the seatback has been moved
20 rearwardly a predetermined distance.

7. Vehicle seat according to claim 8, **characterized** in that the shock
dampers (19) are of hydraulic type, and that the hydraulic oil thereof contains flowable crystals which can be brought to quickly change structure and
direction, whereby said crystals in a first position allows an adjustment of the
25 inclination of the seatback and a resilient moving rearwardly/forwardly of the seatback, whereas said crystals in a second position very drastically increases the damping property and thereby the possibility for the inner frame or the seatback, respectively, to rebounding in the direction forwardly.



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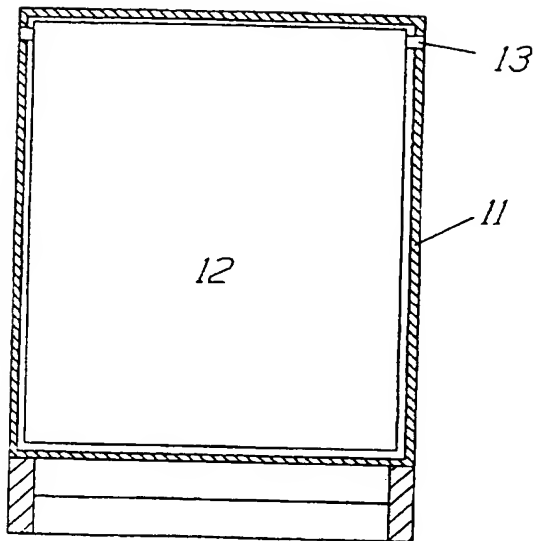


Fig. 5

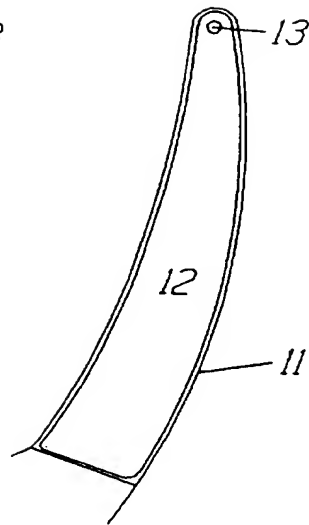


Fig. 6

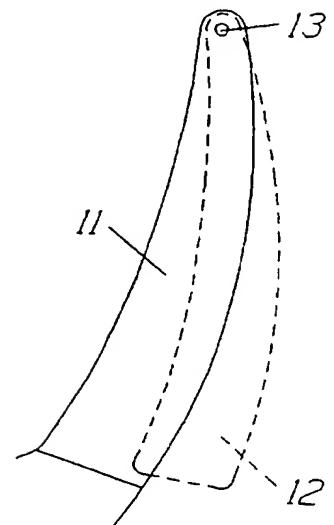


Fig. 7

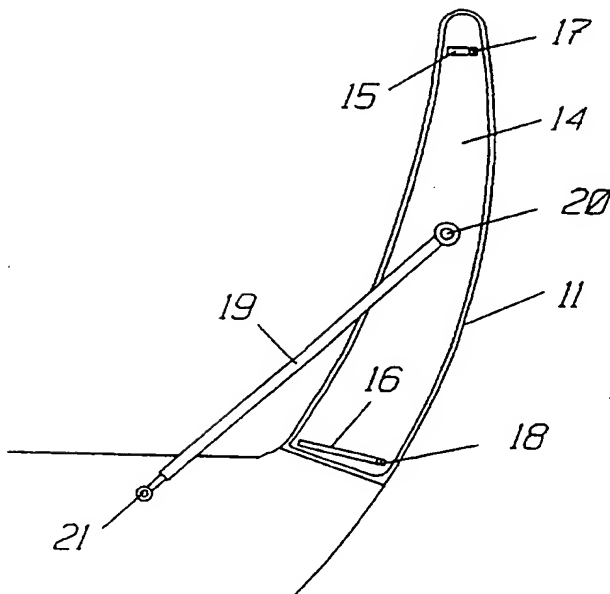


Fig. 8

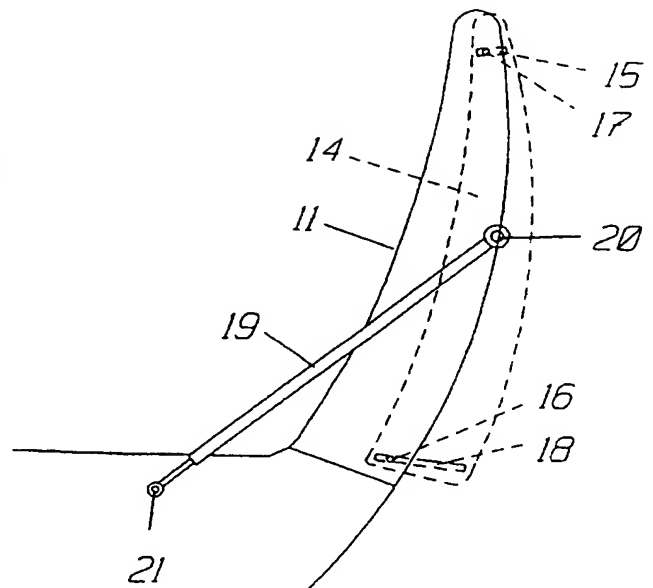


Fig. 9

INTERNATIONAL SEARCH REPORT

1

International application No.

PCT/SE 97/00796

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B60N 2/42

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B60N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 4230670 A1 (DAIMLER-BENZ AEROSPACE AIRBUS GMBH), 17 March 1994 (17.03.94), column 3, line 56 - column 4, line 50, figures 4,6,10, abstract	1,2,3
A	--	4
P,X	DE 19546646 A1 (BERTRAND FAURE EQUIPEMENTS S.A.), 20 June 1996 (20.06.96), column 2, line 35 - column 4, line 4, figures 1,2, abstract	1
P,A	--	2,3,4

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "B" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

19 August 1997

Date of mailing of the international search report

21 -08- 1997

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2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 97/00796

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9606752 A1 (A.K. FÖRVALTNING AB), 7 March 1996 (07.03.96), page 7, line 15 - page 8, line 9, figures 3,4, abstract	1,2
A	--	3,4
X	WO 9511818 A1 (AUTOLIV DEVELOPMENT AB), 4 May 1995 (04.05.95), page 13, line 4 - page 14, line 16, figures 5,6,7	1,5,7
P,X	WO 9710117 A1 (AUTOLIV DEVELOPMENT AB), 20 March 1997 (20.03.97), page 8, line 34 - page 13, line 20, figures 1,2,3, abstract	1,5-10
X	US 3802737 A (MERTENS), 9 April 1974 (09.04.74), column 7, line 64 - column 9, line 34, figures 1,3, 4, abstract	1,5,6,7
A	-----	8-10

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Claims 1-4; An inner part of the seat back in the form of a flowable shepeable material.

Claims 1,5-10; An inner part of the seat back in the form of a rotatable frame.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

06/08/97

International application No.

PCT/SE 97/00796

Patent document cited in search report			Publication date	Patent family member(s)	Publication date
DE	4230670	A1	17/03/94	NONE	
DE	19546646	A1	20/06/96	FR 2728205 A,B	21/06/96
WO	9606752	A1	07/03/96	AU 3402695 A	22/03/96
				CA 2196872 A	07/03/96
				EP 0778806 A	18/06/97
				SE 9402877 A	15/05/96
WO	9511818	A1	04/05/95	AU 8069694 A	22/05/95
				BR 9407894 A	19/11/96
				CN 1133578 A	16/10/96
				EP 0725740 A	14/08/96
				GB 2283163 A	03/05/95
WO	9710117	A1	20/03/97	AU 7004596 A	01/04/97
				SE 9503202 A	15/03/97
				SE 9503316 A	26/03/97
				SE 9503636 A	17/04/97
US	3802737	A	09/04/74	NONE	

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